

Stable angina

IHD is a benign disorder

- Fatty streak appears already in teenagers
- Coronary lesion os less than 50 % diameter, or 70 % area stenosis don't cause symptoms
- Long intervals with or without medical treatment are symptomfree.
- Problems arise only, when the intracoronary plaque becomes unstable

Patients' history (Hx)

- Based on thorough Hx, focused on physical exercise-related symptoms, and also physical exam reveal sufficient information for the physician to estimate the probability of IHD.
- Use diagnostic algorithms to construct your work-up

The definition of angina

- Angina is a clinical syndrome characterized by dyscomfort in the chest, jaw, or shoulder, irradiating into the back or the arm (left).
- It is typically aggravated by exertion or emotional stress
- It is usually relieved by sublingual NG

Angina usually means coronary artery disease (CAD)

- Angina usually develops in pts with CAD in >1 epicardial coronary artery
- Angina may develop in patients without significant CAD (hypertension, HOCM, valvar heart disease) especially in those who prone to coronary spasm (because of endothelial dysfunction).
- Differentiate from esophageal, and chest wall-disorders-caused symptoms

Wording of typical anginal pain

- Usual words : Squeezing, griplike, pressure, suffocating - angina, heaviness
- Sometimes not pain - only discomfort
- Almost never sharp, stabbing, stiching
- Typical gesture - closed fist on the chest
- No changes with posture or inspiration, lasts few minutes, ceases with rest or NG

The CCS Classification of AP

- I. Only strenuous, prolonged exercise results in angina, but normal daily activities don't
- II. Normal daily activity is slightly limited (morning, cold, 2 blocks, one flight)
- III. Marked limitation of normal daily activity
- IV. Inability to carry on any physical activity without discomfort. Angina may be present at rest.

Three types of Unstable Angina

- Rest angina: Occuring at rest, usually last >20 minutes, within a week
- New onset angina: Angina of at least CCS Class III. severity within the last two months
- Increasing (crescendo) angina: more frequent, longer duration, lower threshold

Physical exam

- Usually normal
- 3rd or 4th heart sound, mitral regurgitation murmur, bibasilar pulmonary rales indicate complications.
- Search for non-cardiac disorders: POVD, carotid bruits, abdominal aneurysm, hypertension, chest wall disorders

Lab tests in IHD

- Hemoglobin
- Fasting glucose
- Lipid panel including:
 - total cholesterol
 - HDL cholesterol
 - LDL cholesterol (calculated)
 - triglycerides

Rest ECG

- Rest ECG should be performed in every single patient
- It will be normal in $>50\%$, thus a normal resting ECG will not exclude serious CAD.
- The presence of LVH, or ischemic ST-T changes, or Q waves confirm the suspicion
- Perform ECG during chest pain: High predictive value

Chest X-ray

- Chest x-ray is usually normal, its routine use is not well established.
- The abnormalities are related to previous cardiac events, or to extracardiac comorbid states.
- Fluoroscopy may reveal coronary calcification (high specificity, low sensitivity for CAD)

Ultrafast (electron beam) computed tomography

- EBCT detects and quantitates calcium in the coronary
 - Specificity: 50-60 %
 - Sensitivity 90-95 %
 - Positive predictive value 60-70 %
 - Negative predictive value 99 %

8 -16 - 64 slice CT

- Noninvasive
- Iv. contrastagent
- Good information about calcification
- Poor information within stents

Oxygen demand - supply 1.

- Increased oxygen demand:
 - Non-cardiac
 - hyperthermia, hyperthyroidism, sympathomimetic toxicity, hypertension, anxiety, AV fistula
 - Cardiac:
 - HOCM, aortic stenosis, dilated cardiomyopathy, tachycardia

Oxygen demand - supply 2.

- Decreased oxygen supply:
 - Non Cardiac: anaemia, hypoxemia (pneumonia, asthma, COPB, pulmonary hypertension, pulmonary fibrosis, obstructive sleep apnea), sickle cell disease, sympathomimetic toxicity, hyperviscosity (polycythemia, leukaemia, thrombocytosis, hypergammaglobulinaemia).
 - Cardiac: aortic stenosis, HOCM, CAD

Bayes' theoreme

- The pretest probability of a positive test in a given population strongly influences predictive value of the test.
- Your work-up must consider always this factor

How the pretest probability influences the posttest interpretation

- ETT specificity 90 %, sensitivity 50 %
- In a low probability cohort (5 %) 1000 ETT
 - - 120 + results - 95 have no CAD
 - In a high probability cohort (90 %) a positive ETT increases the probability to 98 %, a negative test decreases to 83 %. A negative test is not sufficient to rule out CAD

Exercise ECG

- Exercise ECG is a well established procedure used for decades.
- Safe (MI or death 1/2500)
- 20-30 % of patients are unable to perform ETT because of contraindication
- Bicycle and treadmill are both useful.
- Use standard, comparable protocols

Class I indication for ETT

- Patients with an intermediate probability of CAD (based on age, gender, symptoms) including patients with RBBB or < 1 mm ST depression at rest
- Excluding patients with WpW sy., PM rhythm. More than 1 mm ST depression at rest, LBBB.
- Established CAD -functional capacity, prognosis

ACC/AHA Classification

- Class I.: Conditions for which there is evidence or general agreement to be useful - SHOULD
- Class IIa.: Conflicting evidence, diverging opinions, but in favour of efficacy - REASONABLE
- Class IIb.: Conflicting evidence, diverging opinions, less well established efficacy – MAY BE CONSIDERED
- Class III.: There is evidence, or general agreement to be ineffective, not useful, can be even harmful – NOT HELPFUL

Ranking of evidences in ACC/AHA guidelines

- A level evidence: Multiple randomized, clinical trials, with large number of patients
- B level evidence : Small randomized trials, or careful analysis of nonrandomized trials, or registries
- C level evidence: No randomized trials, based on expert consensus

ETT standards

- Supervised by a physician (personally?)
- 1 MET = 3,5 ml/kg/min oxygen uptake
- Continuous monitoring for heart rate, blood pressure, ST segment shift, arrhythmias
- Target 85 % of maximal HR, or angina, or >2 mm ST depression (horizontal, or downsloping)
- Maximal HR= 220 - age

Costs of ETT

- ECG ETT is cheap
- Stress echocardiography twofold
- SPECT scintigraphy fivefold
- Coronarography twentyfold

Interpretation of ETT

- Lead selection - more leads-more information
- Upsloping ST segment depression
- ST segment elevation - rare, great likelihood of arrhythmias, probable transmural ischemia
- R wave changes are not reliable

Echocardiography in CAD

- Class I. indication:
 - patients with systolic murmur (AS, HOCM)
 - Evaluation of the severity of ischemia (segmental wall motion abnormality) during pain, or within 30 minutes after pain
- Class II. indication:
 - Patients with a click, or murmur suggestive MVP

Exercise imaging tests

- Myocardial scintigraphy (specificity: 70-85 %, sensitivity: 85-90 %)
 - MIBI, or Thallium
 - SPECT, or planar
 - Physical exercise, or pharmacological stress
- Stress echocardiography: (specificity: 60-90 %, sensitivity: 85-94 %)
 - low-dose dobutamine infusion stress

Indications for stress imaging as initial test

- Class I:
 - Intermediate probability of CAD and WPW, or <1 mm ST depression
 - In patients with previous revascularisation
 - Intermediate probability of CAD and PM rhythm, or LBBB - use adenosine or dipyridamole stress scintigraphy or dobutamine -echo in patients who are unable to exercise

Class II. indications for ETT

- Patients with suspected vasospastic angina
- High probability of CAD
- Low probability of CAD
- Patients taking Digoxin (<1 mm ST depression)
- ECG signs for LVH (<1 mm ST depression)

Technique of coronary arteriography

- Percutaneous insertion of catheter
 - femoral - preformed catheter (Judkins)
 - brachial - Sones
- Fluoroscopy
- Contrast dye injection
- Pressure measurement
- Digital or x-ray cinefilm recording

Risks of coronary arteriography

- Vascular, Arrhythmias, Allergic reactions, Bleeding, Thrombosis, Stroke, AMI
- Morbidity $< 1\%$
- Mortality $< 1\%$

Value of coronary arteriography

- Most accurate diagnostic tool for obstructive atherosclerotic and non-atherosclerotic (Kawasaki, spasm, dissection) coronary disease.
- The only means to disclose coronary anatomy

Coronary arteriography for diagnosis

- Class I. indication: survivors of cardiac death (with possible angina)
- Class IIa.
 - Cost-benefit considerations if noninvasive testing is equivocal.
 - Patients unable to exercise
 - Occupational requirements
 - suspected non-atherosclerotic CAD
 - suspected spasm or LM disease

Coronary arteriography for risk stratification in stable angina

- Class I:
 - CCSC III-IV angina despite medical therapy
 - High risk non invasive test results
 - Anginal patients after sudden death or serious ventricular arrhythmias
 - Angina + cardiac failure
 - High likelihood of severe CAD by clinical characteristics

Medical therapy of angina

- **A: Aspirin and Antianginal (nitrate), ACEI**
- **B: Beta blocker and Blood pressure control**
- **C: Cigarette smoking and Cholesterol lowering**
- **D: Diet and Diabetes control**
- **E: Education and Exercise**

Class I Indication for AP-Aspirin

- Aspirin inhibits cyclooxygenase and platelet thromboxane A₂
- 30-35 % reduction of cardiovascular events (AMI, stroke CV death)
- Frequent GI side-effects
- Does not block all pathways of platelet aggregation
- If contraindicated - clopidogrel

Class I indication for AP - Beta blockers

- Beta blockers decrease HR, afterload (BP), and contractility, the major determinants of oxygen demand
- Aim: resting HR: 55-60/min
- BB are indicated for the initial therapy of AP both for post MI and non MI patients
- Survival benefit proven only post MI
- Contraindications.....

Class I indication for AP - Ca channel blockers

- Ca channel blockers reduce the transmembrane flux of Ca through the Ca channels
- Negative inotrop, reduce smooth muscle cell tension - vasodilation - also in the coronaries
- Reduce blood pressure
- Indicated if BB are ineffective, cause serious side effects, or in combination

Class I indication for AP - long acting nitrates

- Nitrates are endothelium independent coronary vasodilators, reduce oxygen requirement, venodilators, decrease blood pressure
- Indicated if BB are ineffective, cause side effects, or in combination
- Side effects (headache)
- Problem: nitrate tolerance

Class I. indication for AP - short acting nitrates

- Sublingual nitroglycerin, or nitroglycerin spray for the immediate relief of angina
- In case of long lasting pain (suspected AMI) repeat three doses in 5 minute intervals

Class I. indication for AP - lipid lowering therapy (statins)

- Simvastatin, atorvastatin, fluvastatin, rosuvastatin decrease the LDL, and increase the HDL cholesterol level. Decrease the risk of CV outcomes in both primary and secondary prevention
- Goal: LDL cholesterol < 3.0 mmol/lit
- Indicated if LDL cholesterol > 3.4 mmol/lit
- Other lipid lowering agents are also beneficial

Antiplatelet agents

- Aspirin is the standard of care
- Thienopyridines are equally or more effective
- GP IIb/IIIa inhibitors are more potent, more expensive. May be used only on short term (iv).
- The combination of thienopyridines with aspirin may provide a more profound platelet inhibition and treatment benefit

Oral anticoagulants

- Are highly effective in the prevention in the treatment of intracardiac thrombosis
- The combination of antiplatelets with oral anticoagulants carry an additional benefit, but also an additional risk

Revascularization for CAD - 1.

- ACBG aorto-coronary (saphenous) bypass graft operation
 - Favaloro 1971
 - non-beating heart - heart-lung machine, or off pump
 - saphenous vein or IMA bypass
 - almost all patients are suitable
 - high perioperative risk
 - fair, stable medium term results
 - no need (less possibility) for redo

Revascularization for CAD - 2.

- PTCA percutaneous transluminal coronary angioplasty - PCI
 - Grüntzig 1977
 - Percutaneous guiding cath - guide wire - deflated balloon catheter - inflation - stenting
 - only if the lesion is crossed by guidewire
 - low periprocedural risk
 - unstable first six month, frequent restenosis

Indication for ACBG

- Left main stenosis
- Triple vessel disease with poor LV function
- Two vessel disease (prox. LAD) with poor LV function
- One or two vessel disease after successful resuscitation or VT

Indication for PCI

- Two or three vessel disease if the anatomical circumstances are suitable for PCI no diabetes, good LV function
- One, or two vessel disease (no prox. LAD), if a large part of the myocardium is endangered
- In case of restenosis
- In case of stenosis if the medical treatment is insufficient

Management of stable angina

- Chest x-ray in case of HF
- Echocardiography in case of HF or new MI-ECG
- Echocardiography in case of valvular dysfunction
- Exercise tolerance test in case of new symptoms

Imaging during longterm management

- In case of important new symptoms, if....
 - WPW syndrome
 - Pacemaker
 - ST depression at rest
 - LBBB
 - Exercise tolerance test result is uncertain
 - Previous revascularisation